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# CYGNUS-Oz: Australian R&D for a future CYGNUS network of directional dark matter detectors

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The detection limits for WIMP-nucleon scattering are approaching the neutrino floor where coherent neutrino-nucleus scattering will form an irreducible background for many of the dark matter detector technologies currently in use. CYGNUS is a network of international research groups who aim to use directional detection as a means to penetrate the neutrino floor. Their current focus is R&D aimed at optimising gas Time Projection Chambers (TPCs) to achieve low energy thresholds and excellent nuclear recoil track reconstruction, so as to image the recoil tracks caused by WIMP interactions. The long-term goal is to combine results from a network of underground gas TPCs to make a large-scale distributed observatory for nuclear and electron recoils.

Australian researchers have recently formalised the CYGNUS-Oz collaboration so as to concentrate the Australian CYGNUS efforts. A prototype gas TPC is being developed with the ability to handle mixes of up to 3 different gases, and a Gas Electron Multiplier (GEM) amplification stage with wire readout to observe the ionisation track created by a recoiling nucleus within the gas volume. The time of arrival of the charge provides information on the z-component of the track, with limited x-resolution from the wire readout. A photomultiplier tube observes the light from the track ionisation and will be used to gate an intensified camera that will provide high-resolution x-y track information by imaging the scintillation light generated in the avalanche region of the GEMs.

This presentation will present results obtained with the CYGNUS-Oz prototype and also review some of the recent work carried out by the broader CYGNUS collaboration. This includes detector R&D and results from conceptual design studies that discuss the detection limits that can be achieved for both neutrinos and WIMP dark matter, depending on the technological approaches/limits, especially in terms of track reconstruction accuracy and energy thresholds.

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